

Discussion of Claim Rejections

Claim rejections under 35 USC §112.

The USPTO rejected Claims 6 and 15 - 27 under 35 USC §112 asserting that the Markush terminology in those claims was incorrect. The applicants have amended those claims consistent with the recommendation of the Examiner and thus, this rejection has been overcome.

Claim rejections under 35 USC §103.

The USPTO rejected Claims 1, 2, 7, 9, 10 and 12 - 14 under 35 USC §103 as being unpatentable over Zimmermann, et. al., U.S. Patent No. 5,738,350 taken together with Kerby, et. al.. In addition, the USPTO rejected the remaining claims of the application under 35 USC §103 as being unpatentable over Zimmermann, et. al., taken together with Kerby, et. al. and Hamner, U.S. Patent No. 4,212,771. The applicants respectfully traverse this rejection.

The applicants have discovered a new dehydrogenation catalyst, which is particularly useful for vapor phase dehydrogenation. The catalyst comprises chromium oxide on an alumina carrier, with at least two promoters, zirconium and magnesium, and preferably an alkali promoter. The applicants have surprisingly discovered that there is a symbiotic relationship when both zirconium and magnesium are added as promoters to this catalyst. By adding both magnesium and zirconium, the resultant catalyst exhibits higher selectivity

and higher olefin yield after aging than comparative catalysts that merely contain aluminum, chromium, an alkali metal and either, but not both, magnesium or zirconium. (See Table 1, page 20.) This was a surprising result.

Zimmermann, et. al. disclose a dehydrogenation catalyst comprised of an alumina carrier onto which zirconium has been added as a promoter. Zimmermann, et. al. discovered that to enhance the performance of their dehydrogenation catalyst and to reduce coke formation, a cesium promoter must be added to the catalyst. In fact, Zimmermann, et. al. discovered that cesium performs better as a promoter than any of the other alkali metals or any alkaline earth metals.

Further, it can be seen from table I that cesium compounds, in comparison with the other alkalis and alkaline earths, prevent the coke formation most effectively.... As can be seen there is a pronounced minimum of the coke formation between 2 and 3% by weight of CsOH. In these tests performed with propane, except for the very small coke formation, an extraordinarily high selectivity was achieved (selectivity = desired dehydrogenation product x 100:hydrocarbon feedstock). (Col. 6, lines 50 - 63) (Emphasis supplied.)

In fact, Table I of Zimmerman, et. al. discloses that cesium is a better promoter with less coke formation than sodium, calcium, barium or potassium compounds. Accordingly, person skilled in the art reviewing the teaching of Zimmermann, et. al. would be taught to add a cesium compound as a promoter instead of any other alkali or any alkaline earth metal compounds.

While acknowledging that Zimmermann, et. al. fail to disclose

several important elements of the claims of the application, including a) the addition of magnesium, b) the addition of an alkali metal promoter and c) the claimed concentrations of those components, the USPTO asserts that "it would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made to have added the magnesium and the alkali metal promoters into the catalyst of Zimmermann in order to achieve an improved catalyst having promoted activities because they are known as useful catalyst promoters (or modifiers), as evidenced by Kerby...." (Page 6, lines 8-13 of Office Action.) (Emphasis supplied.)

Kerby, et. al. provides a different teaching from Zimmermann, et. al. Kerby, et. al. discloses a dehydrogenation catalyst for a different type of feed stream containing both aromatic and non-aromatic hydrocarbons with a vastly different composition comprising mica, an active metal selected from the group consisting of Pt, Cr, Pd, Ir, Rd and mixtures thereof, and a modifier metal selected from a group consisting of Sn and Ga. To this catalyst Kerby, et. al. suggest that a second modifier selected from the group consisting of alkali metals, alkaline earth metals and rare earth elements can be added. (Col. 2, lines 21 - 26 and Col. 12, lines 12 - 14.)

The applicants respectfully assert that the USPTO has failed to establish *prima facie* obviousness under 35 USC §103 and has

failed to satisfy its own requirements for proof of *prima facie* obviousness as required by MPEP 2142-2143.

The USPTO established a three step test to prove *prima facie* obviousness. The first step requires the Examiner to set forth the differences in the claims over the applied reference or references and to explain the suggestion or motivation in the reference or references which would encourage a person skilled in the art to modify the references to overcome these differences. The second step requires the Examiner to prove that the proposed modification of the references would be likely to arrive at the claimed subject matter. The third step requires the Examiner to explain why the proposed modification would be obvious and how it teaches each claim limitation.

The applicants respectfully assert that the combination of Zimmermann, et. al. with Kerby, et. al. fails to teach at least the first step of this test. This first step requires the Examiner to set forth the differences in the claim over the applied references and then identify specifically where in the prior art there is a motivating suggestion for the modification. In In re Jones, 958 Fed 2nd 347, 21 USPQ 2nd 1941, 1943-44 (Fed. Cir. 1992), the Court explained this requirement as follows:

Before the PTO may combine the disclosures of two or more prior art references in order to establish *prima facie* obviousness, there must be some suggestion for doing so...The prior art must provide one of ordinary skill in the art the motivation to make the proposed molecular modifications needed to arrive at the claim compound.

In the Office Action, the USPTO acknowledged that Zimmermann, et. al. fail to teach the addition of "magnesium, the alkali metal promoter and their concentrations." The USPTO asserts that Kerby, et. al. provides the motivation for the addition of these important elements. While Kerby, et. al. disclose the addition of magnesium to a catalyst as a promoter, there is a notable lack of motivation or a suggestion for adding the magnesium compound of Kerby, et. al. to the catalyst of Zimmermann, et. al. Not only is there a lack of motivation in Zimmermann, et. al. to add magnesium to their catalyst, the composition for the catalyst that is taught by Zimmermann, et. al., in fact, teaches away from the addition of magnesium.

The clear teaching of Zimmermann, et. al. is that a cesium compound must be added as a promoter to the catalyst containing alumina, chromium and zirconium to produce an improved catalyst. Zimmermann, et. al. teaches that cesium performs better than any of the other alkali metals, such as sodium and potassium, or any alkaline earth metals, such as calcium and barium. (See Col. 6, Table 1 and lines 50 - 64.) In particular Zimmermann, et. al. states that

...It can be seen from Table I that cesium compounds in comparison with the other alkalis and alkaline earths, prevent the coke formation most effectively. (Emphasis supplied.)

Further, in their next paragraph Zimmermann, et. al. state that by the addition of the cesium not only is there very small

coke formation but there is "an extraordinarily high selectivity" for the catalyst. Thus, a person skilled in the art reviewing the teaching of Zimmermann, et. al. looking for a promoter for a dehydrogenation catalyst would be taught that a cesium compound must be added to the catalyst instead of any other alkali metal or alkaline earth metal compound. A skilled person reviewing Zimmermann, et. al. would be taught that no other alkali metal or alkaline earth metal promoter would produce the improvement produced when cesium is added as a promoter.

In contrast to the teachings of Zimmermann, et. al., Kerby, et. al. teaches that any alkali metal, alkaline earth metal or rare earth element can be added to the catalyst. A person skilled in the art attempting to combine these references would be taught at best that if an alkali or alkaline earth metal compound is to be added to the dehydrogenation catalyst as a promoter, that compound must be a cesium compound. The teachings of Zimmermann, et. al. thus teach away from the addition of a magnesium compound to the catalyst of Zimmermann, et. al. as a promoter. (MPEP 2144.05 III)

In contrast to the teachings of Zimmermann, et. al. alone or in combination with Kerby, et. al., the applicants have surprisingly discovered that an improved dehydrogenation catalyst can be formed when magnesium is specifically added as a promoter to a catalyst comprising alumina as the carrier, chromium as a promoter and zirconium as a promoter. The applicants have

surprisingly discovered that the combination of zirconium and magnesium produces a catalyst exhibiting vastly improved performance, particularly after aging. As stated in the application "[t]he resultant catalyst exhibit higher selectivity after aging than prior art catalysts." Page 1, lines 14 - 15. Further, the applicants state that

As shown by Table 1, promotion of the catalyst using zirconium and magnesium promoters provide significantly higher selectivity and higher olefin yield after aging than the comparative catalysts. (Page 20, lines 16 - 20.)

Thus, the applicants have discovered that the combination of zirconium and magnesium produces a surprisingly improved catalyst, when compared to the performance of a convention dehydrogenation catalyst. In contrast, Zimmermann, et. al. teaches away from the addition of magnesium to this catalyst and instead teaches that cesium should be added. The combination of Kerby, et. al. with Zimmermann, et. al. does not teach the addition of magnesium to the dehydrogenation catalyst as Zimmermann, et. al. teaches away from that addition. Such "teaching away" obviates any showing of *prima facie obviousness*. (MPEP 2144.05 III, In re Geisler, 116 F.3d 1465, 1471, 43 USPQ 2d 1362, 1366 (Fed. Cir. 1997)).

Note also that Zimmermann, et. al. teaches away from the addition of sodium as an alkali metal promoter, as claimed in Claim 27. Once again Table 1 of Zimmermann, et. al. in Col. 6 clearly teaches that cesium performs significantly better than does sodium

as a promoter for a dehydrogenation catalyst.

Accordingly, the USPTO has failed to establish the motivation to combine Zimmermann, et. al. with Kerby, et. al.. The teachings of the two references are clearly in conflict and no motivation is present for their combination. Thus, *prima facie obviousness* has not been established.

Moreover the USPTO has failed to prove that the use of magnesium as a promoter is a "desirable" modification to this dehydrogenation catalyst. The desirability of the modification must also be established to prove *prima facie obviousness*. (MPEP 2143.01). The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make modification obvious unless the prior art suggested the desirability of the modification. (In re Fritch, 922 Fed. 2nd 1260, 23 USPQ 2nd 1780, 1783 - 84 (Fed. Cir. 1992)). Clearly the desirability of modifying the catalyst of Zimmermann, et. al. by replacing cesium with magnesium is not taught as an opposite result is taught by Zimmermann, et. al. (the addition of cesium).

Finally, the USPTO has failed to show that the motivating suggestion to add magnesium to the dehydrogenation catalyst, which is not present in Zimmermann, et. al., is "explicit" and not merely a vague reference to a possible modification.

...invention cannot be found obvious unless there was some explicit teaching or suggestion in art to motivate one of ordinary skill to combine elements so as to create same invention. (Winner International Royalty Corp. v. Wang, 48 USPQ 2nd 1139, 1140.

(D.C.D.C. 1998))

Clearly there is no teaching within Zimmermann, et. al. that it would be preferable to use magnesium instead of cesium as a promoter nor is there any teaching of the desirability of such modification, much less an explicit teaching or suggestion in Zimmermann, et. al. that would motivate a person skilled in the art to substitute magnesium alone or with sodium for cesium.

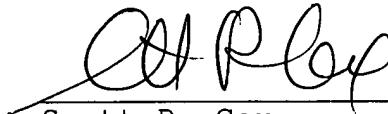
Hamner, U.S. Patent No. 4,212,771.

Hamner fails to add to the teaching of Zimmermann, et. al. and Kerby, et. al. concerning the addition of magnesium to a catalyst as Hamner was merely cited to disclose the composition of the catalyst carrier. (See page 7, line 4 - 7.) Hamner thus provides no teaching as to the desirability of any particular promoter for use with a dehydrogenation catalyst.

CONCLUSION

The applicants respectfully assert that there has not been a *prima facie* showing of obviousness. Accordingly, the claims of the application are distinct from what is taught by the cited references. The applicants request issuance of a Notice of Allowance. If there are any questions concerning this matter, please contact applicants' counsel.

Respectfully submitted,



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